Small Business Innovation Research/Small Business Tech Transfer

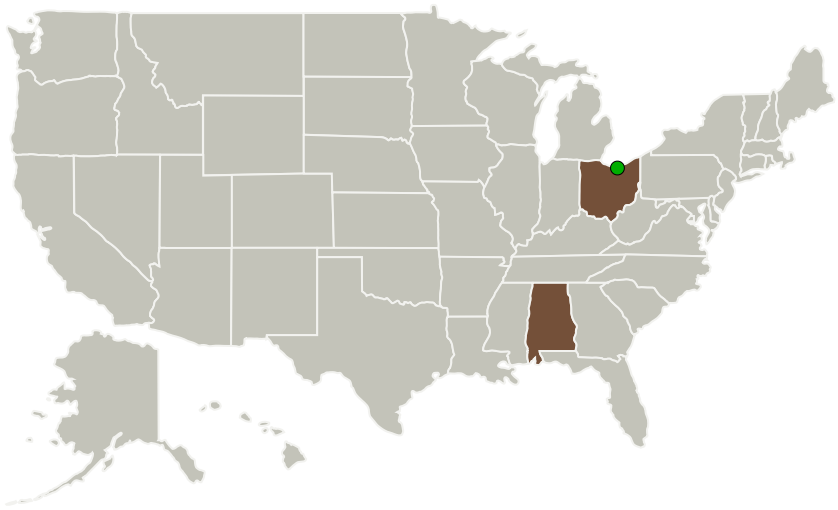
Integrated Fluid and Materials Modeling of Environmental Barrier Coatings, Phase I

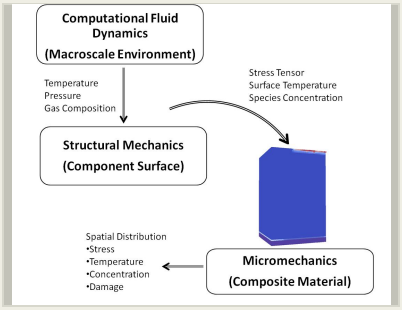
Completed Technology Project (2017 - 2017)

Project Introduction

Environmental barrier coatings (EBC) prevent oxidation of ceramic materials in reactive, high temperature environments such as the exhaust regions of gas turbine engines. CFDRC proposes to a develop a physics based model of an EBC system interacting with the flow environment to provide a means to gain better understanding of the dynamic processes that effect EBC durability and performance under propulsion conditions. The model will use computational fluids dynamics to establish the conditions and species concentrations across the surface of the structure. Structural models of the part based on the finite element method (FEM) will be used to establish the thermal and mechanical loads acting on the coating material. The response of the coating materials will be modeled at the microscale where each component of the coating system is discretely resolved. The micromechanics model is based on peridynamics, a mesh free theory of continuum mechanics that is well suited to model damage in brittle ceramic materials. Recent developments in peridynamics adapted the method to model diffusive transport coupled with deformation and damage, which will be applied to predict the distribution of reactive species over time through the coating system.

Primary U.S. Work Locations and Key Partners





Integrated Fluid and Materials Modeling of Environmental Barrier Coatings, Phase I Briefing Chart Image

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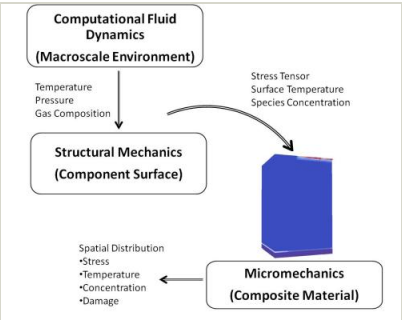
Organizations Performing Work	Role	Type	Location
CFD Research Corporation	Lead Organization	Industry	Huntsville, Alabama
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Alabama	Ohio

Images



Briefing Chart Image
Integrated Fluid and Materials Modeling of Environmental Barrier Coatings, Phase I Briefing Chart Image
(https://techport.nasa.gov/image/136217)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
CFD Research Corporation

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

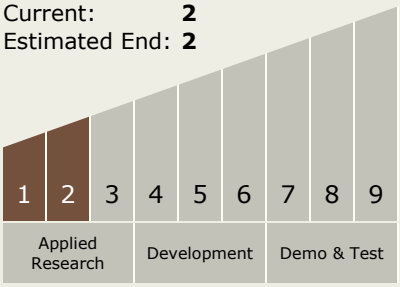
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Bryce Devine

Technology Maturity (TRL)

Start: **1**
Current: **2**
Estimated End: **2**



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Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.1 Materials
    - TX12.1.5 Coatings